

Productivity Enhancement for Primary Care Providers Using Multicondition Care Management

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Objective: To assess the impact of a multicondition care management system on primary care physician efficiency and productivity.

Study Design: Retrospective controlled repeated-measures design comparing physician productivity with the proportion of patients in the care management system.

Methods: The setting was primary care clinics in Intermountain Healthcare, a large integrated delivery network. The care management system consisted of a trained team with nurses as care managers and specialized information technology. We defined the use of the care management system as a proportion of referrals by the physician to the care manager. Clinic, physician, and patient panel demographics were used to adjust expected visit productivity and were included in a multivariate mixed model with repeated measures comprising work relative value units and system use.

Results: The productivity of 120 physicians in 7 intervention clinics and 14 control clinics was compared during 24 months. Clinic, physician, and patient panel characteristics exhibited similar characteristics, although patients in intervention clinics were less likely to be married. Adjusted work relative value units were 8% (range, 5%-12%) higher for intervention clinics vs control clinics. Additional annual revenue was estimated at \$99 986 per clinic. These additional revenues outweighed the estimated cost of the program of \$92 077.

Conclusions: Physician productivity increased when more than 2% of patients were seen by a care management team; the increased revenue in our market exceeded the cost of the program. Implications for the creation, structure, and reimbursement of such teams are discussed.

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For author information and disclosures, see end of text.

Almost half of the American population (125 million people) live with some type of chronic disease.¹ Evidence suggests that more than half of patients with hypertension, diabetes mellitus, hyperlipidemia, congestive heart failure, chronic atrial fibrillation, asthma, and depression are managed inadequately.^{1,2} So great are the need and potential for improvement in chronic disease management that the Institute of Medicine specifically identified chronic disease care as a primary quality improvement area.³

Care management, which involves systematic restructuring of care to assure high quality, has been recommended as a potential solution to the challenges of chronic disease care.⁴ The broad definition of care management described herein includes disease management programs and some case management programs that directly address medical care. By assuring life-saving treatment and by keeping people healthier, care management could save more than \$100 billion and thousands of lives annually.⁵ Many care management programs have taken the form of disease management (adopting guidelines into protocols to ensure higher adherence for specific diseases) or case management (focusing on the patient and his or her family, with patients often selected from among the small percentage that represent the highest cost and utilization). These programs have typically been initiated by the health plan or the employer with the intent to capture savings from the reduced costs of care. They are frequently delivered using telephone and information technology, and initial uncontrolled studies^{4,6} show some promise for effect.

An alternative to disease management programs is care management in the form of the chronic care model. The chronic care model is a multistep program that creates a clinical care team in ambulatory settings, which has shown significant improvements in process and intermediate outcomes in a number of chronic conditions.⁷ However, adoption of primary care-focused care management systems has been slow. In part, this is because of incentive structures within the reimbursement system.⁴ Whereas health plans or employers can reap the benefits of reducing costs for their sickest patients, physician groups that incur the costs of implementing and operating programs often do not receive the associated savings of such an investment. For example, a

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physician's office with a robust program may generate less revenue because healthier patients need less care.⁸

One possibility is to create a business case for these programs (especially for the most complex patients) in the outpatient clinic through increases in productivity. Because most patients with chronic illnesses receive care in primary care settings, efficiencies may be gained if these sites of care could provide high-quality secondary preventive care for multiple disease states.^{9,10} Care management programs can theoretically improve productivity. Because patients who present with multiple challenging problems often reduce productivity in a fee-for-service (or visit) system,¹¹ educating patients to manage their own diseases (self-management) and providing a more seamless interface for their interaction (part of the chronic care model) could reduce these inefficiencies, while improving outcomes.^{12,13}

Augmentation of these models could also provide the flexibility and prioritization needed for patients with coexisting illnesses, who account for most of the expenditures in Medicare.^{14,15} Furthermore, care management offers the promise of improved efficiency through minimization of patient barriers and reduction in the need to implement several different programs for each disease. However, empirical studies in this area are lacking.

The objective of this study is to address this need. We created a model for complex patients based in part on the chronic care model. In this model, called *Care Management Plus* (CMP), a team approach is used in an attempt to create efficient high-quality care. In the CMP model, nurse care managers are positioned in primary care clinics of moderate size (6-10 physicians) and are given extensive training in disease management protocols, motivational interviewing, and assessment of social, economic, and other patient barriers.

While the motivation for employing CMP care managers is to improve the quality of care, CMP may also help physicians to be more productive by reducing the complexity of the office visit, increasing patient understanding, and allocating team tasks more effectively. The opportunity costs for other clinicians relative to these largely unbilled or underbilled tasks may be less as well. In this article, we evaluate the effect of CMP on a specific measure of the productivity of physicians in fee-for-service systems (as measured by work relative value units [wRVUs]). This measure, while limited, relates immediately to revenue generation for these clinics. Our hypothesis is that, as a larger proportion of their regular panel is seen by care managers, physicians will have more productive visits with patients, creating capacity for additional revenue generation, which can allow the clinics to afford some of the costs of the programs.

METHODS

Environment

Intermountain Healthcare is an integrated delivery network consisting of 20 hospitals and more than 1200 employed and affiliated physicians in Utah and Idaho. The 450 physicians employed by the Intermountain Medical Group work in 1 of 92 clinics and provide more than 3 million outpatient visits each year. Clinics have multiple payers, including Intermountain Healthcare, private insurances, and Medicare and Medicaid. Within 7 of its ambulatory clinics that serve adult patients with a diverse spectrum of diagnoses and needs, Intermountain Healthcare augmented primary care services by hiring 1 onsite care manager per clinic. These care managers receive training to address new standards of care as they are adopted by Intermountain Healthcare, as well as ongoing reviews and updates on chronic disease management, care for senior patients, and assistance with barriers of care commonly faced by patients. They also use information technology to access patient information, ensure compliance with adopted standards of care, and improve communication with physicians and other care team members.

Selection of Participants

Physicians were the primary unit of analysis. We divided physicians into the following 4 groups: (1) physicians in the intervention group who did not use CMP or who used it at very low levels, (2) physicians in the intervention group who initially used low levels of CMP or no CMP and increased their use to high levels, (3) physicians in the intervention group who used CMP at high levels throughout the study period, and (4) physicians in the control group who had no access to CMP.

The use of CMP is voluntary, and physicians adopt it at various rates. However, the formal introduction to the program instructs physicians to refer the most complex subset of their patients (usually 3%-5% of the panel), focusing on patients with diabetes mellitus, depression (and other mental illness), cardiovascular disease, and significant social, age-related, and financial barriers.

To account for referral bias in a voluntary program, our empirical approach was designed to isolate the effect of CMP on physician productivity by focusing on the group of physicians who increased their use of CMP (to act as a set of pre-post control subjects) and by comparing their increased productivity with any changes in the baseline productivity of the control group. In a second set of analyses, we expanded our sample to include physicians in the intervention group whose use did not change over time (ie, they used low levels of CMP or no CMP, or they used high levels of CMP). By increasing our sample, we

improved the efficiency of our estimates, at the cost of introducing potential bias associated with greater self-selection.

We included providers who were primary care physicians who saw adults (internists and family practitioners). The providers had to practice at a clinic that had care managers or that was similar to the care manager clinics in terms of specialty, ancillary care, number of physicians, and access to information technology. Finally, the providers had to see patients at least 7 half days per week (80% of a full-time equivalent). Most were full-time providers (8-9 half days per week).

Intervention

The intervention is described in detail elsewhere.⁹ Briefly, once patients are referred to the care management system, the care managers (all registered nurses [RNs]) assess patients and caregivers for readiness to change and for current needs, educate them in their diseases and self-management, and create a comprehensive care plan. Care managers also attend visits with other providers, advocate for their patients, and suggest changes in treatment plans as needed. Role-specific adaptations of the information systems allow easy access to various disease guidelines and to the patients' current adherence to them and summarize patient information, reminder lists, and previously formulated care plans.^{16,17} The care managers are generalists in that they prioritize and treat a large number of illnesses, attempting to create a comprehensive plan that addresses multiple needs. Care managers are encouraged to not simply follow protocols but to create flexible care plans that specifically meet patient needs and to help the patients and caregivers to overcome barriers.

The benefit of the intervention to the physician would occur following the referral to care management, on the patient's return to the physician's practice, with the patient educated, motivated, and ready to manage his or her illnesses. Therefore, the intervention is measured as a percentage of the physician's unique patient population (referred to as a panel) seen by a care manager within 6 months. This percentage increases as the referrals by the physician increase and as the care manager continues to actively follow up the patients.¹⁸ We estimated that 3% to 6% of the average clinic population in the study would be appropriate for care management based on age, comorbidities, and severity of chronic illness. Therefore, a cutoff of 2% was selected as the transition between low use and higher use of the care management system. This study was approved by the appropriate human subjects research ethics review committee.

Measurements

We defined the independent variable of interest, the per-

centage of patients in a physician's panel seen by care managers, as an indicator variable, assigning values of 1 for referral rates of 2% or more and 0 for referral rates less than 2%. To adjust for other factors that might affect physician productivity, we included random effects for the region and clinic, as well as physician-level variables, including time since last training, sex, specialty (internal medicine or family practice), age, and time in the system.¹⁹

Finally, patient-level variables known to affect productivity of outpatient visits were aggregated into summary variables for each physician. Patient panels were created for individual physicians from among patients who had 1 or more visits with the physician during the month in question; this method accounts for crossover of patients (managed by care managers but seen by more physicians than just the primary care provider). For each panel during each month, patient variables were aggregated by provider. These variables included the average case mix of patients seen and the percentages of female, married, and nonwhite patients. Case mix was calculated by means of the Chronic Illness and Disability Payment System, using the adjustment for a general adult outpatient population and averaging the score over the study period.²⁰ A comorbidity score derived from work by Deyo et al²¹ was used to compare referred patients with nonreferred patients.

The work component of the resource-based wRVUs was used as the primary measure of productivity,²² with adjustments for the number of clinic sessions per month for vacations. The number of patient visits was not found to be a useful measure of productivity because of the confounding effect of the intensity of care. To adjust for time spent seeing patients, wRVUs per month were adjusted for clinic days in the single and multivariate models.

Program costs were calculated using median wages for RNs from the Bureau of Labor Statistics (<http://www.bls.gov/>), with benefits calculated at 31% of the total salary. Overhead (computers, space, electricity, and other support) was calculated at 25% of the total costs. Sensitivity analyses were performed based on the mean clinic size (5-10 physicians), RN salary (variation of 10%), and overhead estimates (variation of 10%).

Statistical Analysis

Univariate analyses for baseline variables vs care management were calculated at each level (clinic, physician, and patient) and were tested for significance using *t* test or Mantel-Haenszel χ^2 test. Time-series analysis with multiple nested levels was performed using PROC MIXED in SAS version 9.1 (SAS Institute, Cary, NC). Autoregressive models with single lags, with moving average during 2 months, and with adjustment for heterogeneity were tested. These 3 mod-

els were compared to detect confounding effects in addition to the measurements already given.

RESULTS

In all, 176 providers were potentially eligible for the study. Of these, 56 did not practice continuously for the period required or maintain the necessary clinic sessions, leaving 120 physicians included in the study. As summarized in **Table 1**, 44% of these were internists, and the rest were family practitioners. They came from 30 different clinics within the integrated delivery system. The mean number of months of continuous practice was 22.5 months (of the 24-month maximum) for a total of 2701 physician-months of productivity data. The physicians had been in the system for a mean of 5.2 years and had a mean age of 44.4 years. On average, they saw 353 patients for 464 visits each month.

The care management team saw a mean of 2.5% of each physician's patients each month (with new referrals of 20-40 per physician per month), but this number varied significantly, as shown in **Figure 1**. Physician use was categorized as no or low use and as high use of care management based on their patients' mean utilization of care managers for that month, using 2% as the cutoff between categories. Of 120 physicians, 70 were in control clinics (never having the opportunity to refer), and 5 were in intervention clinics that were not referred patients in any substantial numbers (low/no use). Twenty-four physicians started using care managers during the study period (adopted use), moving from low or no use to high use at a mean of 4.5 months after the beginning of the study. The remaining 21 physicians were high users throughout the study period. The distribution reveals a wide variation in use, with a substantial number of physicians increasing their utilization over time.

Table 2 gives patient characteristics among physicians in the control and intervention clinics. Physicians using care management saw more unique patients, even when the visits per patient in that month were not different. This is especially pertinent for groups who are trying to work smarter (by increasing wRVUs per visit), not simply harder (by seeing more patients). Patient panels seen by physicians who used care management were significantly less likely to be married. However, all panels had a subset of patients who met poten-

■ **Table 1.** Baseline Clinic and Physician Data for Physicians Included in the Study

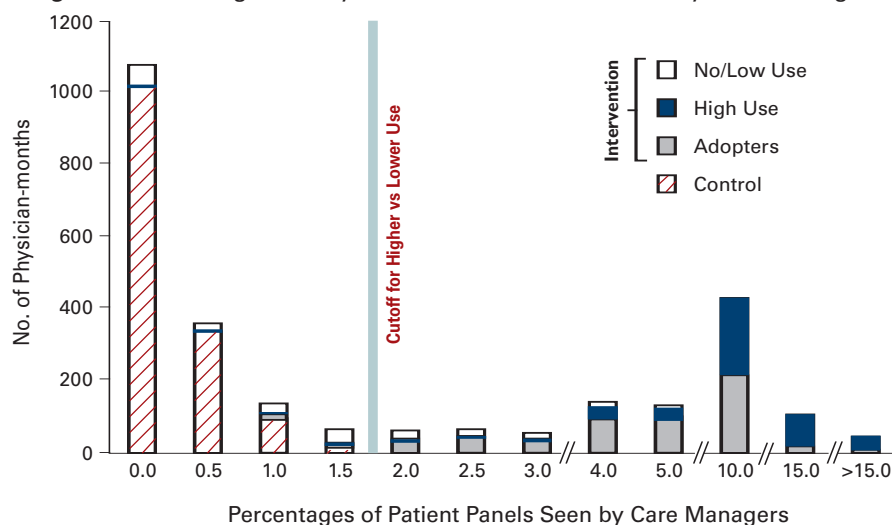
Variable	Value
No. of clinics	30
Mean No. (range) of physicians per clinic	4.0 (1-10)
Mean No. (range) of months of continuous practice	22.5 (7-24)
Total physician-months	2701
No. of physicians	
Total	120
Control clinics (n = 14)*	70
Intervention clinics (n = 7)	50
Use of care management, No. (%)	
No/low	5 (10.0)
Increased during study period	24 (48.0)
High, >2% of panel referred for most months	21 (42.0)
Physician characteristics	
Specialty, No. (%)	
Internal medicine	53 (44.2)
Family practice	67 (55.8)
Age, mean \pm SD, y	44.4 \pm 12.3
Years in system, mean \pm SD	5.2 \pm 3.2
Visits per month, mean \pm SD	464 \pm 76
*100.0% had no or low use of care management.	

tial criteria for referral, namely, multiple severe chronic illnesses (estimated as 5%-10% of panels by comorbidity score), with high utilization within the last year (2%-6% of the total panel), and complicated social factors (1%-2% of the total panel). Overall, about 3% to 6% of patients in a physician's panel met the general referral criteria. In practice, about 75% of those referred had multiple chronic illnesses, 20% had predominating social concerns, and the remainder had severe illness or other factors. Physicians with very high referral percentages tended to have more complex patient panels and to refer for single severe disease states.

Table 2 also gives unadjusted physician productivity for the control and intervention clinics. Physicians were more productive (based on wRVUs) during months when they used care management. The higher productivity associated with care management was evident among physicians in all 30 clinics and within the 7 clinics that used care managers.

Figure 2 shows the raw and predicted wRVUs from 3 multivariate models. In general, the effect was strong. The raw wRVU gain for care management was 8% (adjusted gain, 5%-9%) when comparing all clinics and was higher (raw gain, 9%; adjusted gain, 8%-12%) when comparing physicians in clinics using care management.

■ **Figure 1.** Percentages of Physicians' Patient Panels Seen by Care Managers



Control physicians, by default, refer no patients to the care managers; however, care management patients are frequently seen in those clinics in a crossover effect. The cutoff seeks to allow for this crossover while anticipating a threshold effect (approximately 50% of the 3%-6% of the most complex patients in a panel most likely to benefit from the program).

Multivariate models, including the autoregressive form (model 1, 1 month: $P = .02$) and the moving average (model 2, 3 months' moving average: $P = .03$), exhibited a significant relationship between higher care management use and wRVUs earned. In an effort to isolate the benefits of adoption, we also provide estimated raw wRVUs and estimates from model 1 in which our analysis was restricted to the group of

Larger clinics (10 physicians) had break-even points beyond the bounds of the analysis.

physicians who adopted care management during the study. This model was significant, and the predicted wRVUs showed a large increase (14% relative increase) for the months with high proportions managed by the care management team.

The cost of the program per practice was estimated at \$92 077. At \$36 per wRVU, the benefits per a 7-physician practice were \$99 986 (derived from the mean increase per model, or 33 wRVUs per physician per month), a savings per clinic of \$7909. Sensitivity analyses revealed the following break-even points: RN wages +9%, 6 physicians, and \$33 per wRVU.

DISCUSSION

Our model of care management had a significantly positive effect on physician productivity, even after adjusting for factors

■ **Table 2.** Patient Characteristics Among Physicians in the Control and Intervention Clinics

Variable	Control Clinics	Intervention Clinics				P*
		Low ($\leq 2\%$) CM Use	All High ($>2\%$) CM Use	Adopted Use Before CM	Adopted Use After CM	
Physician Characteristics						
Physician-months	1487	253	961	108	425	—
No. of unique patients seen, mean \pm SD	360.7 \pm 142.8	363.6 \pm 152.1	357.6 \pm 171.8	357.0 \pm 107.7	395.3 \pm 166.6	.35
No. of visits per patient per month, mean \pm SD	1.1 \pm 0.8	1.2 \pm 0.9	1.3 \pm 0.9	1.2 \pm 0.7	1.1 \pm 0.8	.32
Patient Panel Characteristics						
Age, mean \pm SD, y	44.5 \pm 8.3	43.8 \pm 7.9	42.8 \pm 8.8	40.5 \pm 8.8	41.7 \pm 8.6	.45
CDPS score, mean \pm SD	0.77 \pm 0.26	0.92 \pm 0.26	0.79 \pm 0.24	0.78 \pm 0.24	0.75 \pm 0.26	.84
White race/ethnicity, %	6.8	6.8	7.0	7.2	7.1	.40
Married, %	57.9	58.2	56.8	58.9	60.1	.35
Adjusted wRVUs, mean \pm SD	379.3 \pm 114.8	388.8 \pm 115.2	412.2 \pm 133.2	356.4 \pm 108.3	405.5 \pm 118.3	<.001

*High-use intervention clinics vs control clinics (t test for means and Fisher exact test for proportions).

CM indicates care management; CDPS, Chronic Illness and Disability Payment System; wRVUs, work relative value units (adjusted for clinic sessions per month [mean, 36 half-day sessions per month]).

known to affect a physician's output over time. The primary effect was seen within 1 month after the care management team was managing about 2% of a physician's panel (all from voluntary referral) and persisted in a 1-month lag model and in a 3-month moving average model. This productivity gain was even more pronounced among physicians who started as low users and increased their use during the study period.

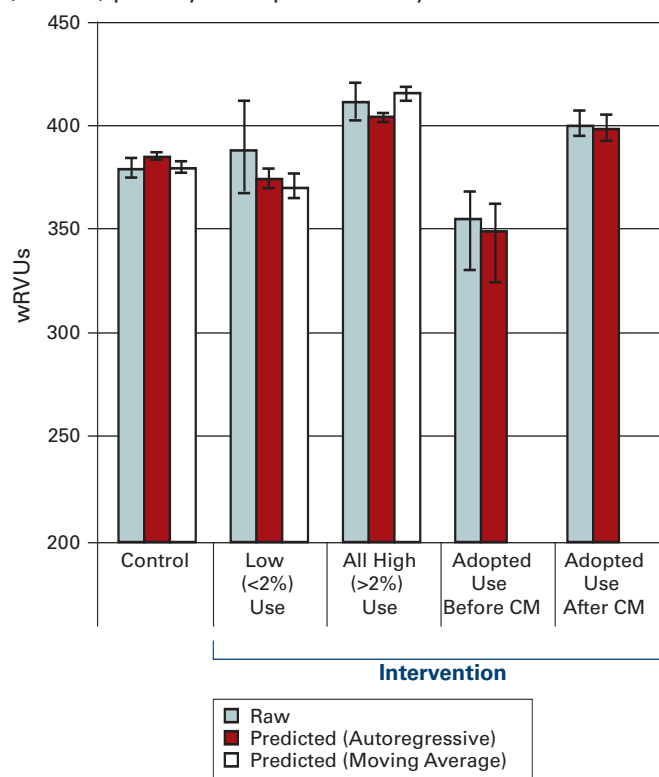
Are the potentially higher revenues from increased productivity enough to justify the costs associated with a program like CMP? A basic assumption is that CMP employees will be salaried and represent a fixed cost for the institution. We estimate that the revenue gains from physician productivity outweigh the costs of CMP when 1 full-time nurse manager equivalent can be shared between 7 to 10 physicians; at a 3% referral rate with a mean panel size of 2300, the care manager would cover 16 100 to 23 000 patients and would actively see 483 to 690 per year, matching the current number seen by care managers in our clinics.

The benefits of CMP extend beyond improved financial viability. At the clinic level, CMP offers the potential for reimbursement for patient education and for assistance in physician and staff retention through greater job satisfaction. At the societal level, CMP has been shown to improve patient health and may lead to fewer sick days.⁹ It is our expectation that studies such as the present one will convince clinics, provider organizations, and integrated delivery networks that investment in collaborative care agents and technology is not only beneficial to society by improving patient health but also economically sustainable.²³

Changes in reimbursement to reward the higher quality of care from these programs may be forthcoming. For instance, the Medicare Prescription Drug Improvement and Modernization Act of 2003 explores incentives for physicians to implement interventions like CMP through a series of programs. The combination of these trends with the efficiency benefits may make this model more appealing.²⁴

This work has several limitations. First, the observational nature of this study makes it difficult to establish a direct causal link between CMP and physician productivity, especially the potential for confounding between the outcome variable (physician productivity) and the independent variable of interest (care management). However, the pre-post nature of our analysis, in conjunction with a comparison group that had no access to CMP, should minimize this potential bias. Furthermore, the results of this study match those of a recent qualitative study²⁵ of perceived physician benefits; in that study, 7 of 10 physicians who had started using care man-

Figure 2. Raw and Adjusted Work Relative Value Units (wRVUs) per Physician per Month by Use and Model



Error bars indicate 95% confidence intervals; CM, care management.

agers believed that they were more productive after their patients had been seen by a care manager.

Second, wRVUs may not reflect the productivity goals for society or even some formal economic definitions of productivity. These wRVUs were drawn from estimates of actual and perceived effort, a measure more of input than output. Because reimbursement is based on these scores, it was determined to be the best available estimate of physician output that would accrue directly to providers and their organizations.

Third, focusing only on adult primary care providers limits the analysis; subspecialists such as gastroenterologists and rheumatologists effectively act as primary care providers for the kinds of complex patients in this sample. Care manager contact was measured dichotomously herein, and a more accurate measure may be care manager "dosage" or effort over time.²⁶

Fourth, the immediate costs of implementing the program assume some previous costs endured by the clinics or system. All clinics had significant health information technology. In addition, the time and resource cost to transform guidelines into protocols delivered at the point of care can be substantial, and these costs were already invested in these clinics. However, these previous investments were equal in all clinics

Take-away Points

Primary care physicians who engaged in Care Management Plus, a program using care managers and technology to help manage complex patients, had 8% to 12% increase in productivity. Such improvements occurred when physicians adopted and sustained the program, using it intensively. Decision makers should be aware that:

- The increased relative value units (RVUs) paid for the cost of the care manager, leading to increased adoption across the system
- Increased RVUs were only partially from increased visits; increased documentation and selection of different physician activities also contributed
- Environmental conditions (fee-for-service, unmet demand) likely created the opportunity to increase productivity and remuneration.
- Minimum clinic size to successfully pay for the program was 7 to 10 physicians; other clinic sizes would require different reimbursement structures.
- Other benefits included higher satisfaction and quality of care.

in the study, including the control clinics. The ability to actually implement the protocols was aided by the care managers, as seen in previous research.²⁷ Only the 15% to 20% of clinics or systems that have made the decision to invest in these other components would gain immediate benefits from the adoption of CMP. The costs of the training are also not included; a 20-hour training program is now offered free to all interested clinics (<http://www.caremanagementplus.org>).

CONCLUSIONS

Clinic-based care management can significantly increase the productivity of physicians who refer patients to care management. The magnitude of this increase can provide a financial benefit to moderately sized adult outpatient clinics that almost compensates for the cost of the care management program. This benefit is likely to grow even greater as the reimbursement system is changed to further reward the health benefits gained through this program and others like it.

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